

# PI 7-3 installation guide

<http://www.renishaw.com>

## PI 7-3 installation guide

Documentation part number: H-1000-7555-02-B



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# General information

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### WEEE



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### Warranty

Renishaw plc warrants its equipment for a limited period (as set out in our Standard Terms and Conditions of Sale) provided that it is installed exactly as defined in associated Renishaw documentation.

Prior consent must be obtained from Renishaw if non-Renishaw equipment (e.g. interfaces and/or cabling) is to be used or substituted. Failure to comply with this will invalidate the Renishaw warranty.

Claims under warranty must be made from authorised service centres only, which may be advised by the supplier or distributor.

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### Care of equipment

Renishaw probes and associated systems are precision tools used for obtaining precise measurements and must therefore be treated with care.

### Changes to Renishaw products

Renishaw reserves the right to improve, change or modify its hardware or software without incurring any obligations to make changes to Renishaw equipment previously sold.

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# EC declaration of conformity

Renishaw PLC hereby declares that the PI 7-3 is in compliance with the essential requirements and other relevant provisions of Directive 2004/108/EC. Contact Renishaw plc if a copy is required.

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### FCC (USA only)

#### Information to user (47CFR section 15.105)

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case you will be required to correct the interference at your own expense.

#### Information to user (47CFR section 15.21)

The user is cautioned that any changes or modifications not expressly approved by Renishaw plc or authorised representative could void the user's authority to operate the equipment.

#### Equipment label (47CFR section 15.19)

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference
2. This device must accept any interference received, including interference that may cause undesired operation.

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### Safety

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

There are no user serviceable parts inside the equipment.

The PI 7-3 probe interface is to be used with the provided PSU - Emerson DP4024N3M. See manufacturer's datasheet at [www.emerson.com](http://www.emerson.com)

PSU electrical ratings	
Supply voltage	100 V to 240 Vac +10%, -10%
Frequency range	50 Hz to 60 Hz
Power consumption	6 W max
Transient voltages	Installation category II

**NOTE:** For PI 7-3 controller ratings refer to section 'Power supply'.

The PI 7-3 is isolated from ac power by disconnection of the IEC mains connector from the supplied PSU. If any additional means of isolation is required, it must be specified and fitted by the machine manufacturer or installer of the product. The isolator / disconnection device must be sited within easy reach of the operator and comply with any applicable national wiring regulations for the country of installation.

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# Environmental conditions

The following environmental conditions comply with those defined in BS EN61010 - 1:2001:

<b>Indoor use</b>	IP30 (no protection against water)
<b>Altitude</b>	Up to 2000 m
<b>Operating temperature</b>	0 °C to +50 °C
<b>Storage temperature</b>	-10 °C to +70 °C
<b>Relative humidity</b>	80 % maximum for temperatures up to +31 °C. Linear decrease to 50 % at +50 °C
<b>Pollution degree</b>	2

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### Introduction

The PI 7-3 is a dedicated signal conditioner for interfacing the TP7M series of probes or touch-trigger probe types such as TP2, TP20 or TP6 / TP6A, to the CMM controller.

PI 7-3 interface unit - A-5726-0100



PI 7-3 integrated card option - A-5726-0200



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# Product description and pin outs

### Technical description

The PI 7-3 automatically recognises the probe type, determines the probe status, which is either triggered or seated (armed), and transmits debounced signals to the CMM controller. Status and control signals are transferred between the PI 7-3 interface, other Renishaw equipment and the CMM controller via the product interconnection system (PICS) ports. The TP7M probe series employ silicon strain sensors to detect the small gauging forces applied to the stylus tip. There is no electronic processing in the probe and the sensors are connected directly to the interface via the Renishaw autojoint connector, the probe head and associated wiring. The sensor signals are amplified and the resultant 'probe signals', proportional to changes of strain, are compared with reference voltages to determine the status of the probe.

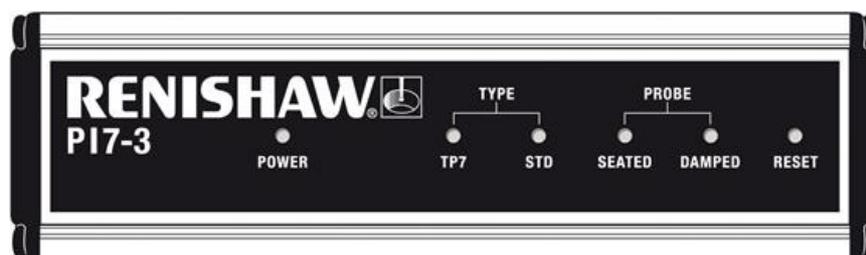
The initial value of strain in the sensor structure will vary with the mass of the stylus and the orientation of the probe. At switch-on or following re-orientation of the probe on a movable head, a process known as 'autozero' is used to rapidly null the strain to a zero reference level.

When the stylus contacts the workpiece, a change of strain occurs in the probe structure causing the probe signal voltage to exceed the trigger reference level. A probe trigger signal condition occurs by asserting SYNC on the PICS port. As stylus deflection increases, the probe signal voltage will exceed the halt reference level and HALT will be asserted on the PICS port. When the stylus backs-off the workpiece, the probe signal falls below the reference levels; SYNC and HALT are cleared to the seated state and the sensor outputs are nulled to the zero reference level in preparation for the next trigger. Debounce timers allow the motion characteristics to stabilise after the initial trigger and reseat events, to prevent spurious switching.

A solid state relay (SSR) equivalent of the SYNC output is provided for controllers requiring a voltage free contact at their probe input.

There is a choice of two levels of trigger sensitivity to allow the TP7M series to be used on a wide range of CMM types or in situations where the ambient vibration levels are not ideal.

### Front panel indicators



Indicator		Colour	Function
POWER	ON	Green	Mains power on
TYPE	STD	Green	Touch-trigger probe selected
	TP7	Green	TP7M series probe selected
PROBE	SEATED	Green	ON - probe (seated)
			OFF - probe triggered or no probe connected
	DAMPED	Yellow	PDAMP asserted

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## Reset switch

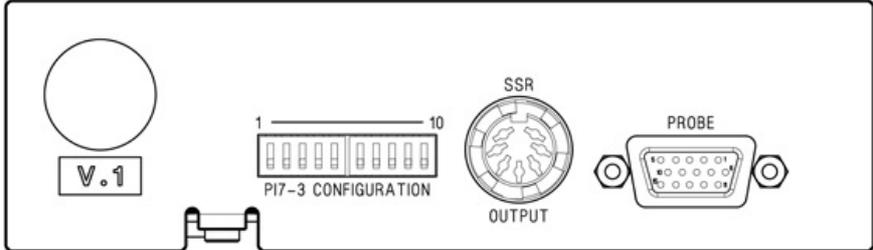
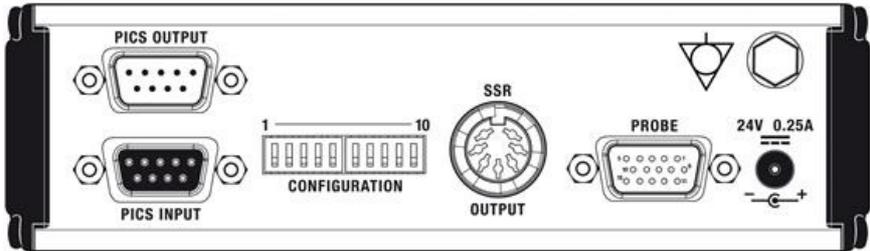
Automatically, the probe will reset to the armed state when the PI 7-3 is powered up. Occasionally, it may be necessary to perform a manual reset, for example after changing the probe stylus.

Press the RESET button on the front panel for two seconds to reset the probe to the armed (seated) state.

**CAUTION:** Pressing the RESET button inhibits probe triggers. Before pressing the button, the CMM must be stationary, in manual mode, with the stylus clear of the workpiece.

**NOTE:** The action of unlocking and locking the PH10 series motorised head will perform the same function as the RESET button.

## Configuration switches



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Switch no.	Function	Position	Description
1	SSR invert	UP	SSR closed when probe seated
		DOWN	SSR open when probe seated
2	Buzzer	UP	Audible indication of probe trigger - OFF
		DOWN	Audible indication of probe trigger - ON
3	Kinematic probe input	UP	Autojoint input only
		DOWN	PICS input enabled
4	Probe type	UP	Optimise for issue '01' (or later) probe
		DOWN	All probe types
5	STOP disable	UP	No response to PICS - STOP
		DOWN	Trigger outputs respond to PICS - STOP
6	HALT invert	UP	PICS - HALT output active HIGH
		DOWN	PICS - HALT output active LOW
7	HALT mode	UP	HALT generated internally
		DOWN	HALT asserted by PICS
8	Auto reset	UP	Probe will reset after 2 seconds
		DOWN	Automatic reset disabled
9	Trigger sensitivity	UP	Level 2 (mid sensitivity)
		DOWN	Level 1 (high sensitivity)
10	Extended debounce	UP	Custom settings as per special product A-1073-0544
		DOWN	Standard mode

### Switch 1

The solid state relay (SSR) output contacts may be set to be open when the probe is seated and closed when the probe is triggered. The output may be inverted to mimic the action of a kinematic probe.

### Switch 2

The internal audible indicator normally gives a short tone burst when the SYNC output changes from the seated to the triggered state. The switch may be set to enable or disable the sound.

### Switch 3

With switch 3 UP, the PI 7-3 will automatically change operating modes from TP7M to kinematic probe types (TP2, TP20 or TP6/TP6A) when a TP6A probe or PAA series adapter is attached to the Renishaw autojoint connector on the probe head. Switch 3 should be set to the DOWN position only when it is necessary to connect a kinematic probe or an electronic trigger, from an external source, to the PICS input connector. For example, this will be necessary if the TP7 is fully integrated with the TP200 probe on the same installation.

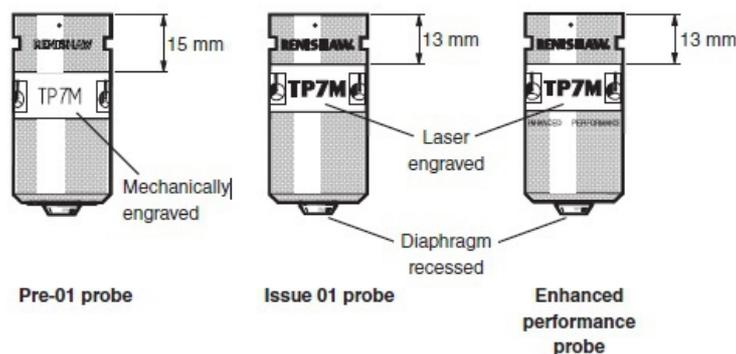
### Switch 4

Early versions of the TP7M probe required faster resetting than the '01' (or later) issue (after January 1995). Where only the '01' or later versions are to be used, switch 4 should be set to the UP position to optimise the reset function. This will reduce the possibility of an incorrectly seated probe occurring in situations where the back-off from the gauge point is slow or where the stylus 'skates' on the surface. Switch 4 should be set to the DOWN position where the 'pre-01' probe or mixed types are used. The DOWN position provides equivalent function to previous versions of the PI 7.

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The TP7M probe types may be recognised by the differences in appearance shown below.



### Switch 5

With switch 5 DOWN, the SYNC, HALT and SSR outputs will go to the triggered state when the CMM controller or other Renishaw equipment asserts the PICS STOP line. Setting switch 5 UP disables the response.

### Switch 6

The HALT output at the PICS connector is active low with switch 6 DOWN but may be inverted by selecting switch 6 UP.

### Switch 7

Set switch 7 to the UP position for normal operation with the TP7M or kinematic probes (TP2, TP20 or TP6/TP6A). For fully integrated operation of the TP7M with the TP200 probe on the same installation, set switch 7 to the DOWN position to allow the HALT signals from the PI 200 interface to be automatically routed to the CMM controller when the probe is changed.

### Switch 8

Set switch 8 DOWN for normal operation with the automatic reset disabled. Set switch 8 UP to select automatic reset of the probe 2 seconds after triggering. This facility is included for compatibility with previous versions of the PI 7.

### Switch 9

Set switch 9 DOWN for normal operation with the TP7M at its highest sensitivity (level 1) and lowest error.

Under certain conditions, vibration may cause false 'air' triggers during gauging and it may be necessary to reduce the probe's sensitivity. False triggers may occur when large or heavy stylus arrangements are used, or where there is floor transmission from nearby machinery or vehicles. Set switch 9 UP to select level 2. This will reduce sensitivity to vibration but with a small loss of measuring accuracy.

### Switch 10

Set switch 10 UP to operate as the custom product A-1073-0544 which has a modified debounce time.

**NOTE:** All configuration switches are hardware controlled and do not require the PI 7-3 to be switched off and on again to make the selection active.

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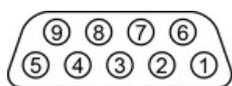
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### Connector pins

Refer to the Renishaw installation guide 'Product interconnection system – PICS' (part number H-1000-5000) for the electrical specification of the PICS signals.

### PICS output connector

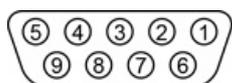
The PICS output connector is a 9 pin 'D' type plug. The pin numbers (viewed on the rear panel) are shown in the table below.



Pin no.	Function	Pin no.	Function
1	STOP	6	HALT
2	PPOFF	7	PDAMP
3	0 V	8	LEDOFF
4	Reserved for Renishaw use	9	Not used
5	SYNC (probe trigger)	Shell	Screen

### PICS input connector

The PICS input connector is a 9 pin 'D' type socket. The pin numbers (viewed on the rear panel) are shown in the table below.



Pin no.	Function	Pin no.	Function
1	STOP	6	HALT IN
2	PPOFF	7	PDAMP
3	0 V	8	LEDOFF
4	LED anode	9	Probe return (0 V)
5	Probe input	Shell	Screen

### Solid state relay (SSR) connector

The SSR output connector is a 7 pin DIN socket. The pin numbers (viewed on the rear panel) are shown in the table below.

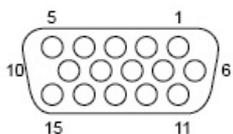
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Pin no.	Function	Pin no.	Function
1	0 V	5	Probe status 2
2	Not used	6	Not used
3	Not used	7	Not used
4	Probe status 1	Shell	Screen

### Probe multiwire cable



Pin no.	Function	Pin no.	Function
1	REF GAUGE	9	NC
2	0 V	10	NC
3	TP2 RETURN	11	GAUGE 1
4	GAUGE 2	12	NC
5	GAUGE 3	13	TP2 INPUT
6	+5 V	14	HEAD POSITIVE
7	-5 V	15	HEAD LED RETURN
8	PROBE ID	Shell	SCREEN

### Dimensions

<b>Enclosure style</b>	1/3 rack (19 inch) × 1U
<b>Overall dimensions</b>	155 mm × 44 mm × 180 mm
<b>Mounting method</b>	Rack mounting or free standing
<b>Weight</b>	1.25 kg

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# Replacement of PI 7, PI 7c and PI 7H

The following table relates the PI 7-3 configuration switches to the previous standard and custom versions of the PI 7.

Function	PI 7-3	PI 7-2 *	PI 7-2 #	PI 7	PI 7c	PI 7H
SSR invert	Sw1 UP DOWN	Sw1 UP DOWN	Sw1 UP DOWN	Sw2 UP DOWN	Sw2 UP DOWN	Sw2 UP DOWN
Buzzer off	Sw2	Sw2	Sw2	'VOL' on rear panel	'VOL' on rear panel	'VOL' on rear panel
Kinematic probe input	Sw3 UP DOWN	Sw3 UP DOWN	Sw3 UP DOWN	Sw6 UP DOWN	Sw6 UP DOWN	Sw6 UP DOWN
Probe type	Sw4	Sw4	Sw4	No function	No function	No function
STOP disable	Sw5 UP DOWN	Sw5 UP DOWN	Sw5 UP DOWN	Internal Sw3 on motherboard UP DOWN	Internal Sw3 on motherboard UP DOWN	Internal Sw3 on motherboard UP DOWN
HALT invert	Sw6 UP DOWN	Sw6 UP DOWN	Sw6 UP DOWN	No function	Internal Sw1 on LED board RIGHT LEFT	Internal Sw1 on LED board RIGHT LEFT
HALT mode	Sw7 UP DOWN	Sw7 UP DOWN	Sw7 UP DOWN	No function	No function	Internal Sw2 on LED board RIGHT LEFT
Auto reset	Sw8 DOWN	Sw8 DOWN	Sw8 RIGHT	Sw4/5 Sw4 DOWN Sw5 DOWN	Sw4/5 Sw4 DOWN Sw5 DOWN	Sw4/5 Sw4 DOWN Sw5 DOWN
	Sw8 UP	Sw8 UP	Sw8 LEFT	Sw4 UP Sw5 DOWN	Sw4 UP Sw5 DOWN	Sw4 UP Sw5 DOWN
Trigger sensitivity	Sw9	Sw9	Sw3	Sw3	Sw3	Sw3
Level 1	DOWN	DOWN	RIGHT	DOWN	DOWN	DOWN
Level 2	UP	UP	LEFT	UP	UP	UP
Extended debounce	Sw10 UP	Special product A-1073-0544	Special product A-1073-0544	Special product A-1073-0544	Special product A-1073-0544	Special product A-1073-0544
Grounding	Function deleted	Function deleted	Function deleted	Sw1	Sw1	Sw1

\* Version 13 and above.

# Version 12 and below.

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# Installation procedure

**WARNING:** Ensure the PI 7-3 is disconnected from the mains supply during installation.

**WARNING:** Do not exceed the operation ambient of 50 °C around the unit. Do not install near sources of heat. Forced cooling may be required in final installation.

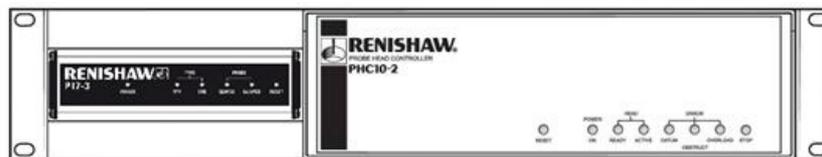
### Rack mounting

The PI 7-3 may be mounted in a 19 inch equipment rack or may be free standing.

To mount the PI 7-3 alone requires 2 × 1/3 blanking panel kits (A-1018-0179).



If the PI 7-3 is to be placed next to a PHC10-2 use panel kit A-1018-0173



### System interconnection

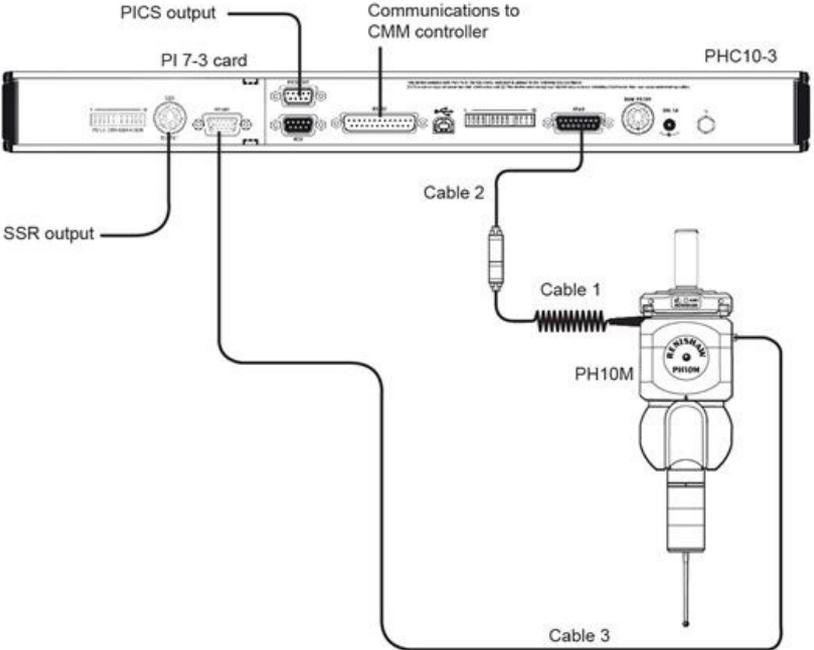
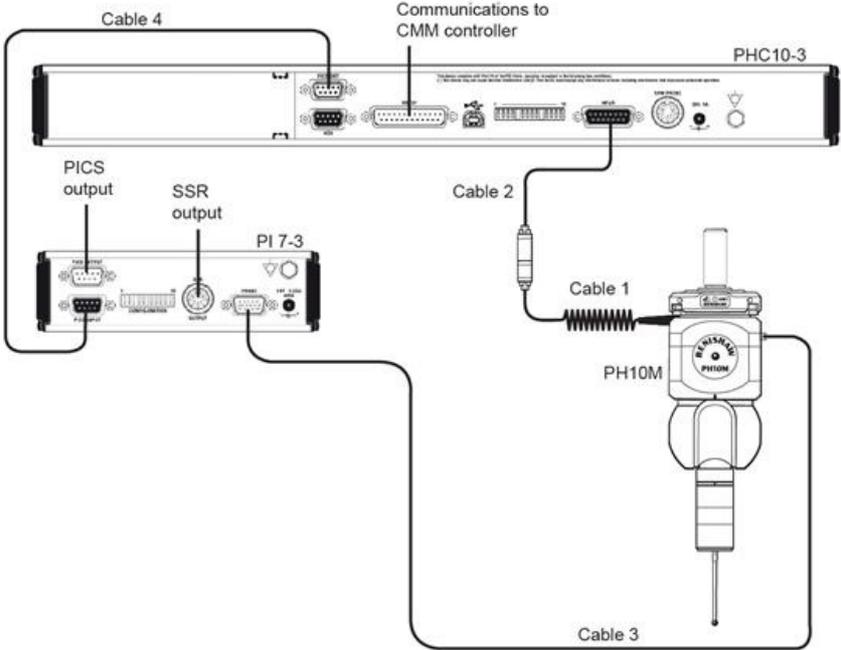
The interconnections for the TP7 system on a PH10M motorised probe head are shown in the following illustrations.

**NOTE:** The first illustration refers to the external PI 7-3 unit and the second shows information regarding the integral card version of the product. The table gives a list of alternative standard Renishaw cable lengths and part numbers.

Refer to the Renishaw PH10M system installation guide (H-1000-5071) for further information.

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Cable no.	PL no.	Length (m)	Part number	Notes
1	PL5	0.4 to 0.8	A-1016-7672	Coiled
	PL6	0.8 to 1.6	A-1016-7673	Coiled
	PL12	0.1	A-1016-7674	Plain
	PL13	0.1 to 0.2	A-1016-7675	Coiled
2	PLM6	6	A-1016-7564	Unterminated
	PLM7	4	A-1016-7563	Unterminated
	PLM8	6	A-1016-7677	
	PLM9	4	A-1016-7678	
3	PL38	25	A-1016-7625	Unterminated
	PL42	15	A-1016-7624	Unterminated
	PL56	12	A-1016-7617	Unterminated
	PL44	8	A-1016-7627	Unterminated
	PL46	3.7	A-1016-7628	Unterminated
	PL45	1.8	A-1016-7629	Unterminated
4	PL25	0.3	A-1016-0120	

**i NOTE:** Cables marked 'unterminated' are supplied with one end prepared but unterminated. The connector parts are supplied for fitting after routing of the cable in the installation.

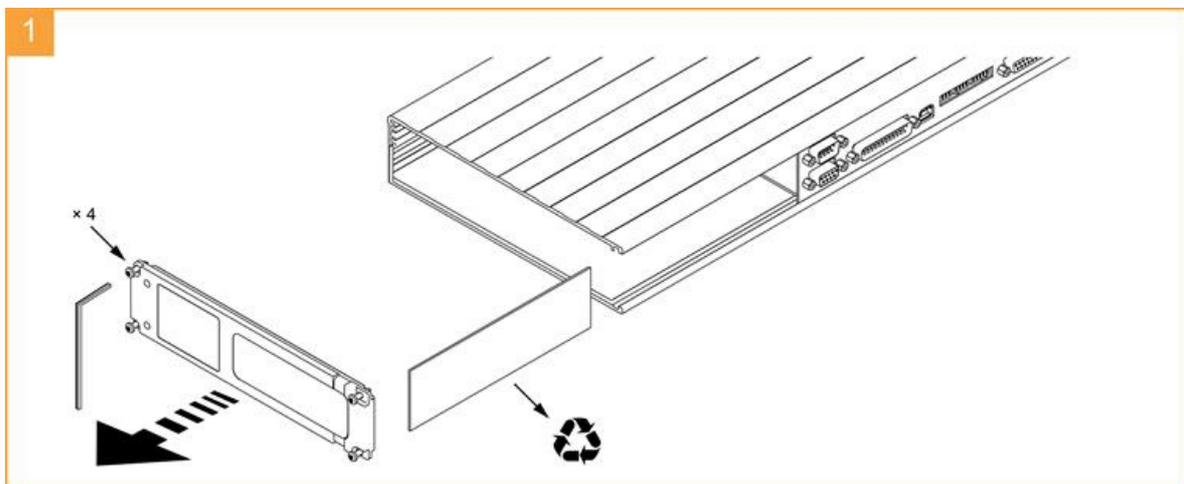
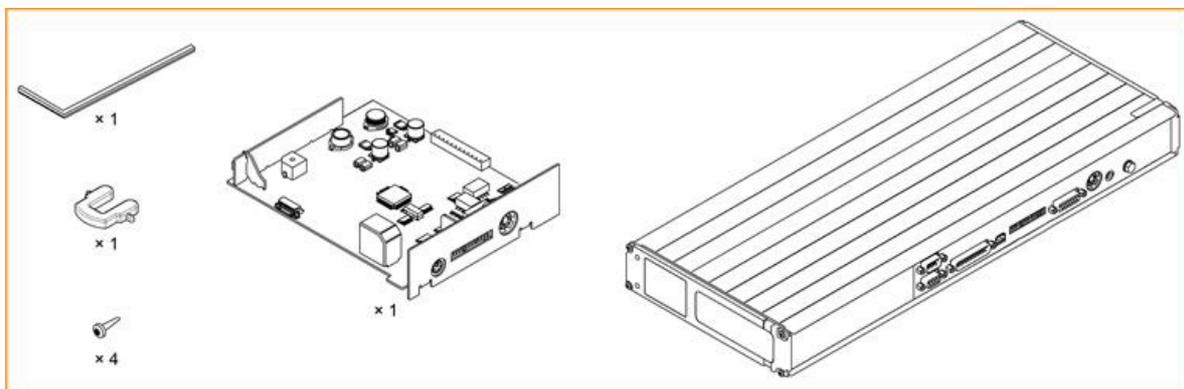
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### Installing external card

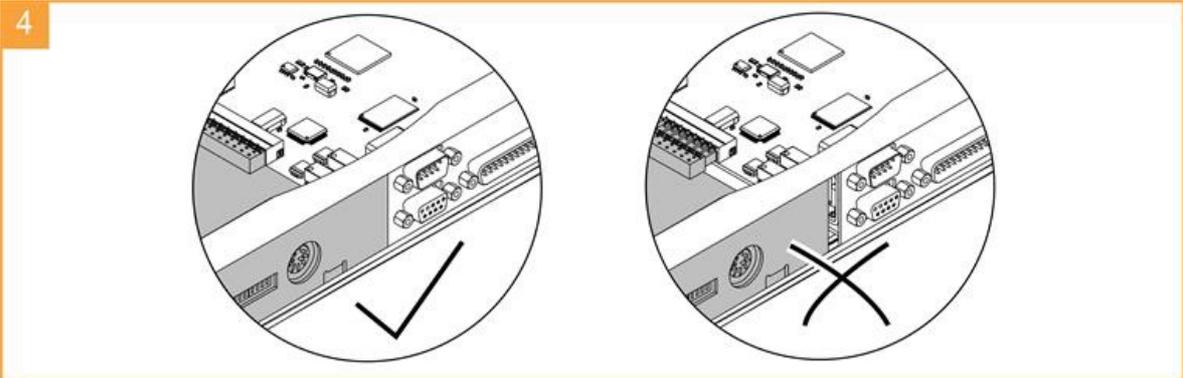
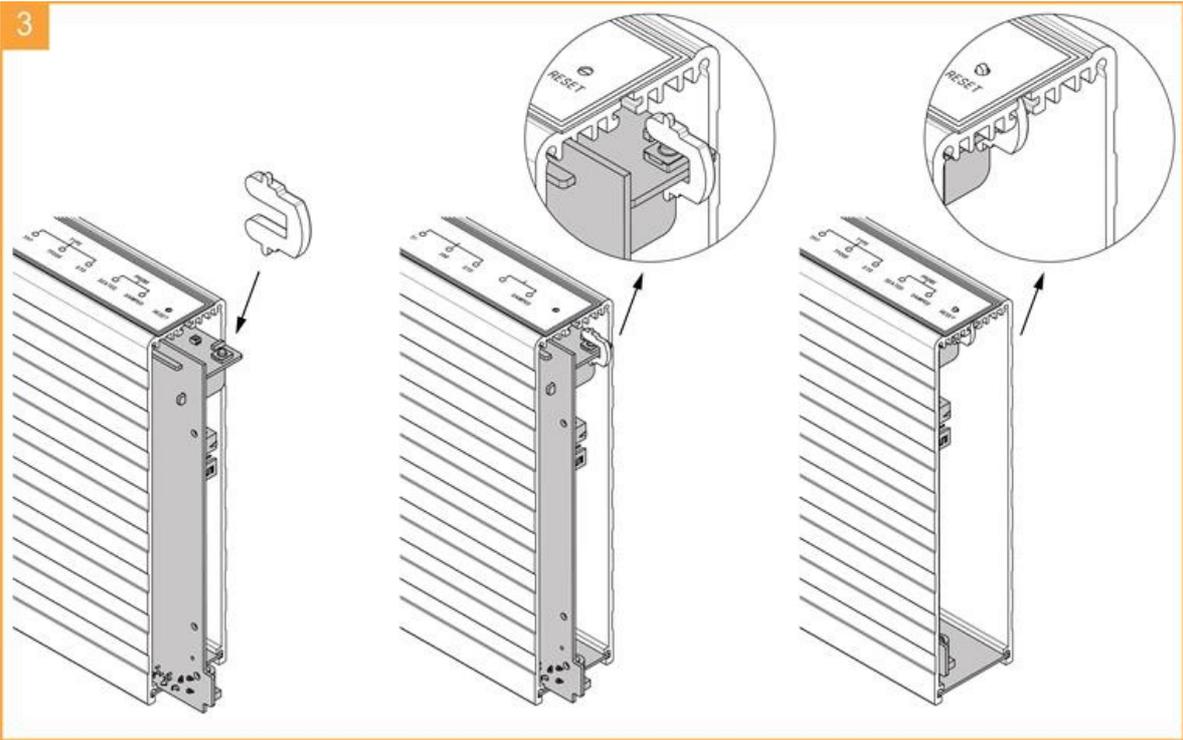
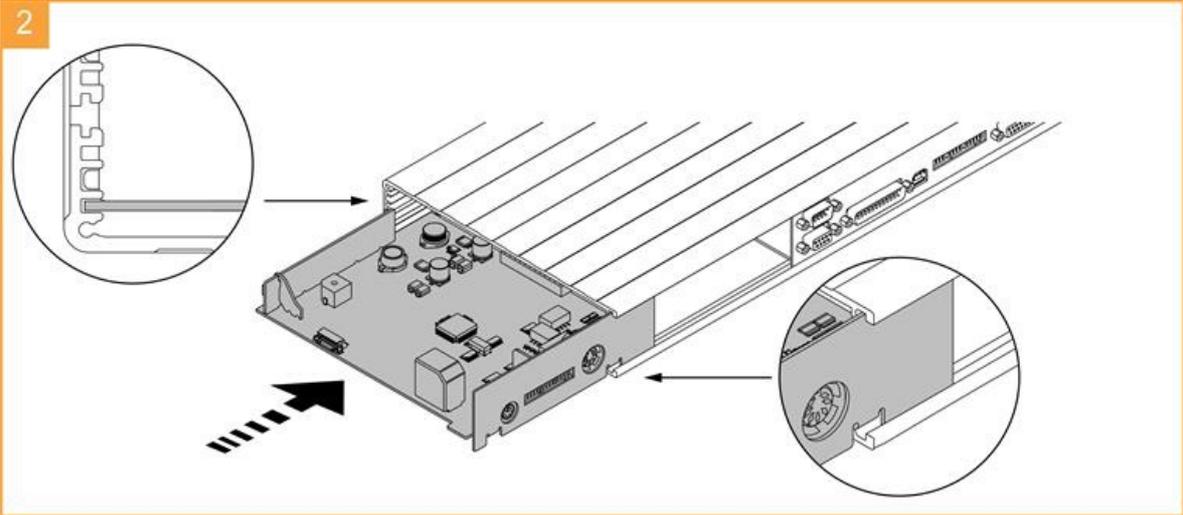
- Remove the end panel of the PHC10-3 PLUS with a hex-key and slide out the blanking plate
- Insert the PI 7-3 card, ensuring that the card is located in the correct grooves shown in the following illustration
- Insert the reset actuator over the top of the reset button on the PI 7-3 card and then replace the end panel

#### Inserting PI 7-3 card into PHC10-3 PLUS



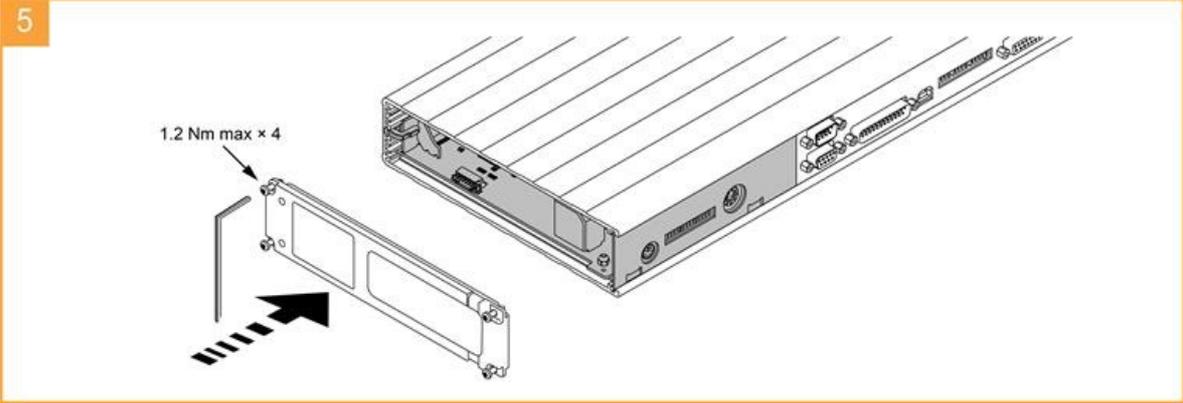
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### Maintenance

- Check the security of mounting screws and electrical connectors
- Remove dust from the external surfaces with a proprietary cleaning cloth
- There are no user serviceable parts within the PI 7-3
- Renishaw recommends regular CMM calibration to ensure optimum metrology performance

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# Power supply

### Powering the PI 7-3

The PI 7-3 TP7 interface is to be used with the provided PSU - Emerson DP4024N3M AC power adaptor ([www.emerson.com](http://www.emerson.com)). This is a 24 Vdc 49 W supply and is connected to the PI 7-3 via Ø5.5 mm dc jack plug.

PI 7-3 does not require a protective earth, however an equipotential bonding point is provided on the rear panel for connection to the rest of the installation.

- PI 7-3 interface is rated to operate at +24 Vdc 0.25 A max input current

If an internal interface is fitted with the PHC10-3 PLUS, it will obtain its power internally from the PHC10-3 PLUS controller.

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